

WHAT IS CLAIMED IS:

1. A polymer membrane mesh, the membrane mesh comprising a first surface having first surface pores, a second surface having second surface pores, and a support structure between the first surface and the second surface, the support structure having a reticular network of flow channels connecting the pores of the first surface with the pores of the second surface, wherein both or either of the first surface pores and the second surface pores have an average pore diameter of greater than or equal to about 10  $\mu\text{m}$ .
2. The membrane of Claim 1, wherein the average pore diameter of at least the first surface pores or the second surface pores ranges from greater than about 20  $\mu\text{m}$ .
3. The membrane of Claim 1, wherein the average pore diameter of at least the first surface pores or the second surface pores ranges from about 10  $\mu\text{m}$  to about 200  $\mu\text{m}$ .
4. The membrane of Claim 3, wherein the average pore diameter of at least the first surface pores or the second surface pores ranges from about 20  $\mu\text{m}$  to about 150  $\mu\text{m}$ .
5. The membrane of Claim 4, wherein the average pore diameter of at least the first surface pores or the second surface pores ranges from about 30  $\mu\text{m}$  to about 100  $\mu\text{m}$ .
6. The membrane of Claim 1, wherein the membrane possesses a bubble point of less than about 1 psi.
7. The membrane of Claim 1, wherein the membrane possesses a water flow rate of greater than about 30,000 ml/min for a 90 mm diameter disc of the membrane at a pressure of 10 psi.
8. The membrane of Claim 1, wherein the membrane has a thickness greater than about 50  $\mu\text{m}$ .
9. The membrane of Claim 1, wherein the membrane has a thickness ranging from about 50  $\mu\text{m}$  to about 500  $\mu\text{m}$ .
10. The membrane of Claim 9, wherein the membrane has a thickness ranging from about 75  $\mu\text{m}$  to about 200  $\mu\text{m}$ .

11. The membrane of Claim 10, wherein the membrane has a thickness ranging from about 90  $\mu\text{m}$  to about 150  $\mu\text{m}$ .

12. The membrane of Claim 1, wherein the polymer comprises a sulfone polymer.

5 13. The membrane of Claim 12, wherein the sulfone polymer is selected from the group consisting of polyethersulfone, polyarylsulfone, polysulfone, and mixtures thereof.

14. The membrane of Claim 1, wherein the polymer is selected from the group consisting of polyvinylidene fluoride, acrylic copolymer, polyolefin, polyester, 10 polytetrafluoroethylene, polyurethane, polycarbonate, poly(tetrafluoroethylene-co-ethylene), polyamide, polystyrene, and mixtures thereof.

15. The membrane of Claim 11, wherein the polyolefin is selected from the group consisting of polyethylene and polypropylene.

16. The membrane of Claim 1, further comprising a hydrophilic component.

15 17. The membrane of Claim 13, wherein the hydrophilic component is selected from the group consisting of polyvinylpyrrolidone, polyethylene glycol, polyvinylacetate and mixtures thereof.

18. The membrane of Claim 13, having a weight ratio of polymer to hydrophilic component from about 1:20 to about 20:1.

20 19. The membrane of Claim 15, wherein the weight ratio ranges from about 1:10 to about 10:1.

20. A method for preparing a polymer membrane mesh, the method comprising:

25 providing a casting dope comprising a polymer, a nonsolvent, and a solvent;

casting the dope to form a thin film;

exposing the film to a humid atmosphere for a period of time sufficient to allow formation of surface pores greater than about 10  $\mu\text{m}$  in diameter;

coagulating the film in a coagulation bath; and

30 recovering from the coagulation bath a polymer membrane mesh, the membrane mesh comprising a first surface having first surface pores, a second

- 5 surface having second surface pores, and a support structure between the first surface and the second surface, the support structure having a reticular network of flow channels connecting the pores of the first surface with the pores of the second surface, wherein both or either of the first surface pores and the second surface pores have an average pore diameter greater than about 10  $\mu\text{m}$ .
21. The method of Claim 17, further comprising:  
 rinsing the mesh in a rinsing bath, wherein said rinsing step is conducted after said coagulating step.
- 10 22. The method of Claim 17, further comprising:  
 drying the mesh at an elevated temperature.
23. The method of Claim 17, wherein the period of time ranges from about 20 seconds to about 2 minutes.
24. The method of Claim 20, wherein the period of time ranges from about 20 seconds to about 70 seconds.
- 15 25. The method of Claim 21, wherein the period of time ranges from about 30 seconds to about 60 seconds.
26. The method of Claim 20, wherein the period of time ranges from about 35 seconds to about 55 seconds.
- 20 27. The method of Claim 17, wherein the humid atmosphere has a humidity ranging from about 30% relative humidity to about 100% relative humidity.
28. The method of Claim 17, wherein the humid atmosphere has a humidity ranging from about 40% relative humidity to about 100% relative humidity.
29. The method of Claim 17, wherein the humid atmosphere has a humidity ranging from about 40% relative humidity to about 70% relative humidity.
- 25 30. The method of Claim 22, wherein the humid atmosphere has a humidity ranging from about 50% relative humidity to about 69% relative humidity.
31. The method of Claim 23, wherein the humid atmosphere has a humidity of about 55% relative humidity.
- 30 32. The method of Claim 17, wherein the dope comprises a homogeneous solution.
33. The method of Claim 17, wherein the dope comprises a dispersion.

34. The method of Claim 17, wherein the nonsolvent is selected from the group consisting of alcohols, alkanes, ketones, carboxylic acids, ethers, esters, and mixtures thereof.

35. The method of Claim 17, wherein the nonsolvent is selected from the group consisting of 2-methoxyethanol, propionic acid, t-amyl alcohol, methanol, ethanol, isopropanol, hexanol, heptanol, octanol, acetone, butyl ether, methylethylketone, methylisobutylketone, ethyl acetate, amyl acetate, glycerol, diethyleneglycol, di(ethyleneglycol)diethylether, di(ethyleneglycol)dibutylether, polyethylene glycol, propionic acid, hexane, propane, nitropropane, heptane, octane, and mixtures thereof.

36. The method of Claim 17, wherein the nonsolvent comprises water.

37. The method of Claim 29, wherein the nonsolvent comprises a mixture of polyethylene glycol and water.

38. The method of Claim 17, wherein the dope comprises from about 12 wt. % to about 32 wt. % of nonsolvent.

39. The method of Claim 31, wherein the dope comprises from about 15 wt. % to about 29 wt. % of nonsolvent.

40. The method of Claim 32, wherein the dope comprises from about 18 wt. % to about 26 wt. % of nonsolvent.

41. The method of Claim 33, wherein the dope comprises from about 20 wt. % to about 24 wt. % of the nonsolvent.

42. The method of Claim 17, wherein the solvent is selected from the group consisting of dimethylformamide, dimethylacetamide, dioxane, dimethylsulfoxide, chloroform, tetramethylurea, tetrachloroethane, and mixtures thereof.

43. The method of Claim 17, wherein the solvent comprises N-methylpyrrolidone.

44. The method of Claim 17, wherein the dope comprises from about 50 wt. % to about 80 wt. % of solvent.

45. The method of Claim 37, wherein the dope comprises from about 55 wt. % to about 75 wt. % of solvent.

46. The method of Claim 38, wherein the dope comprises from about 60 wt. % to about 70 wt. % of solvent.
47. The method of Claim 39, wherein the dope comprises from about 64 wt. % to about 66 wt. % of solvent.
- 5 48. The method of Claim 17, wherein the dope comprises from about 2 wt. % to about 20 wt. % of polymer.
49. The method of Claim 41, wherein the dope comprises from about 4 wt. % to about 15 wt. % of polymer.
50. The method of Claim 42, wherein the dope comprises from about 5 wt. % to about 10 wt. % of polymer.
- 10 51. The method of Claim 17, wherein the polymer comprises polysulfone.
52. The method of Claim 44, wherein the dope comprises about 9 wt. % of polysulfone.
53. The method of Claim 17, wherein the dope further comprises a hydrophilic component.
- 15 54. The method of Claim 46, wherein the dope comprises from about 1 wt. % to about 10 wt. % of hydrophilic component.
55. The method of Claim 47, wherein the dope comprises from about 2 wt. % to about 6 wt. % of hydrophilic component.
- 20 56. The method of Claim 48, wherein the dope comprises from about 3 wt. % to about 5 wt. % of hydrophilic component.
57. The method of Claim 49, wherein the dope comprises from about 4 wt. % to about 5 wt. % of hydrophilic component.
58. The method of claim 46, wherein a weight ratio of polymer to hydrophilic component ranges from about 1:5 to about 20:1.
- 25 59. The method of claim 46, wherein the weight ratio ranges from about 1:2 to about 1:4.
60. The method of claim 51, wherein the polymer comprises polysulfone.
61. The method of Claim 17, wherein the coagulation bath comprises water.
- 30 62. The method of Claim 17, wherein the coagulation bath is at a temperature ranging from about 2°C to about 85°C.

63. The method of Claim 54, wherein the coagulation bath is at a temperature ranging from about 24°C to about 63°C.

64. The method of Claim 55, wherein the coagulation bath is at a temperature ranging from about 32°C to about 54°C.

5 65. The method of Claim 56, wherein the coagulation bath is at a temperature ranging from about 38°C to about 48°C.

66. The method of Claim 17, wherein the rinse bath comprises water.

67. The method of Claim 17, wherein the membrane mesh possesses a bubble point of less than about 1 psi.

10 68. The method of Claim 17, wherein the membrane mesh possesses a water flow rate of greater than about 30,000 ml/min for a 90 mm diameter disc of the membrane at a pressure of 10 psi.